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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/616,917	07/11/2003	Takashi Nishikawa	63979-028	2411

7590 03/03/2006

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EXAMINER

ROSE, KIESHA L

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 03/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/616,917	NISHIKAWA ET AL.	
	Examiner	Art Unit	
	Kiesha L. Rose	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6, 22 and 23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 22-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 7/11/03 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This Office Action is in response to the RCE filed 27 December 2005.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6 and 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujimori et al. (U.S. Patent 6,674,109) in view of Halliyal et al. (U.S. Patent 6,674,138).

In re claim 1, Fujimori discloses a nonvolatile memory (Figs. 1 and 2) that contains a semiconductor substrate (1), a source region (2) and a drain region (3), which are formed on the semiconductor substrate with a channel region (4) therebetween; a floating gate electrode (6) that is formed on the channel region with a gate insulator film (5) therebetween, a ferroelectric film (7) that is formed on the floating gate electrode and a control gate electrode (8) that is formed on the ferroelectric film, wherein an intermediate insulator film (10) is formed between at least one of the pairs consisting of the floating gate electrode and the ferroelectric film and the ferroelectric film and the control gate electrode. The intermediate insulator film is formed of a high-K dielectric material. (Column 4, lines 23-27) Fujimori discloses all the limitations except

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for the intermediate insulator film made of hafnium oxide that contains nitrogen atoms. Whereas Halliyal discloses a nonvolatile memory device (Fig. 2) that contains an intermediate insulator film (30) containing hafnium oxide with nitrogen atoms. The intermediate insulator film is formed of hafnium oxide with nitrogen atoms to fully replace the nitride layer and to act as a charge storage layer. (Column 6, lines 9-22 and Column 7, lines 29-37, Table 1) Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Fujimori by incorporating the intermediate insulator film formed of hafnium oxide with nitrogen atoms to fully replace the nitride layer and to function as a charge storage layer and to allow low electrical thickness as taught by Halliyal.

In re claim 2, Fujimori discloses the intermediate insulator film formed between both the floating gate electrode and the ferroelectric film and between the ferroelectric film and the control gate electrode. (Figs. 1 and 2 and Column 6, lines 8-12)

In re claim 3, Halliyal discloses the gate insulator film made of hafnium oxide that contains nitrogen atoms. (Fig. 1, Column 5, lines 9-12 and Column 6, lines 9-19)

In re claims 4-6, Halliyal discloses the intermediate insulator film contains nitrogen atoms of not less than 0.1 atomic % and not more than 30.0 atomic %. (Column 7, lines 35-50)

In re claim 22, Fujimori discloses the floating gate electrode comprises metal. (Column 5, lines 28-29)

In re claim 23, Fujimori discloses the ferroelectric film comprises a metal. (Column 5, lines 29-30)

Response to Arguments

Applicant's arguments with respect to claims 1-6 and 22-23 have been considered but are moot in view of the new ground(s) of rejection. In regards to applicant's arguments that refer to the Halliyal reference being inoperable with the intermediate insulator film comprising hafnium oxide with nitrogen atoms is erroneous. It is unclear how the nonvolatile memory would be inoperable since the Halliyal reference discloses replacing the nitride layer of the nonvolatile memory device with a high-K dielectric material, which is hafnium oxide with nitrogen atoms. Halliyal discloses that by replacing the nitride layer with a high-k dielectric material (hafnium oxide) then it would function as a charge storage layer and therefore would not be inoperable in the Halliyal reference but would rather be operable and much desired by the Halliyal reference. Therefore the rejection stands.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kiesha L. Rose whose telephone number is 571-272-1844. The examiner can normally be reached on T-F 8:30-6:00 off Mondays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


KLR